DOCUMENT RESUME

ED 234 810 IR 050 442

AUTHOR	Lewis, David W.
TITLE	The Use of the Journal Access Service and Its Implications for Journal Selection at the Center for Research Libraries.
SPONS AGENCY	Council on Library Resources, Inc., Washington, D.C.
PUB DATE	10 Jun 83
NOTE	96p.; Best copy available.
PUB TYPE	Reports - Research/Technical (143)
EDRS PRICE	MF01/PC04 Plus Postage.
DESCRIPTORS	*Academic Libraries; Guidelines; Library Acquisition; Library Collections; *Library Material Selection; Library Networks; Library Research; *Models; National Programs; *Periodicals; Prediction; Regression (Statistics); *Research Libraries; Use Studies
IDENTIFIERS	British Library Lending Division; *Center for Research Libraries IL; *Document Delivery Service; Resource Sharing

ABSTRACT

In order to develop guidelines for the selection of journals by the Center for Research Libraries, a study was done of the use made of the Center's Journal Access Services (JAS), which supplies photocopies of journal articles to member institutions from the Center's collections and from the British Library Lending Division (BLLD). Based on a sample group of 1,010 journal titles from the 1976/77 "Ulrich's International Periodical Directory," it was found that most of the journal use came from a very few titles, that over 70% of the titles used were published in English, and that over 50% of the titles used were in the areas of science and technology. The study indicates the existence of a class of journals which require regular use by the research library community but are not frequently held by its members. This document describes similar BLLD use studies, journal selection models, predictors of future journal use, and study methodology and results. It is concluded that the Center can play a significant role in a cooperative journals acquisitions program by selecting journals that are indexed; published outside the United States, Canada or the United Kingdom; and held by no more than 25 academic libraries in the United States, but held by at least two libraries. It is also recommended that titles that have been used be given priority over those that have not. A 51-item bibliography is provided. (ESR)

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ED234810

THE USE OF THE JOURNAL ACCESS SERVICE AND ITS IMPLICATIONS FOR JOURNAL SELECTION AT THE CENTER FOR RESEARCH LIBRARIES

by

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June 10, 1983

IR050442

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INTRODUCTION

The Center for Research Libraries (the Center) is exploring the issue of expanding its journal collections. As part of this effort this study examines the use made of the Center's Journal Access Services (JAS). The JAS provided delivery of copies of journal articles published after 1970 to the Center's full members and associate members with two or more Ph. D. programs. The articles were supplied from the Center's collections and from the collections of the British Library Lending Division (BLLD). It is hoped that, as a result of this study it will be possible to develop decision rules or guidelines for the Center's selection of journals. If the Center can to some degree predict journal use, it can use its funds more wisely. In considering the problem we will examine the experience of the BLLD and the literature of journal selection modeling and of journal use.

It is not clear to some that the Center has a role to play in the area of journals. Even JAS has been the subject of debate. Some members find it by far the most valuable of the Center's services. Others see as inappropriate the Center's role as middleman in a document delivery system. These members see much of the use of JAS as illegitimate. It is the Center's purpose generally to provide access to infrequently held but significant items in support of its members. It is not clear that journals which meet these requirements exist. An important part of this study will be to investigate this issue. From this we will also gain some indication of how much of the use made of the JAS service might have been filled elsewhere.

If a class of journals that meets the Center's requirements is identified, we will also consider the alternative strategies the Center might use in approaching the collection of these journals.

ACKNOWLEDGEMENTS

This study was conducted as part of the Council on Library Resources Fellowship program at the Graduate Library School, University of Chicago. The opportunity for a year of study provided by the Council and the GLS made this project possible. During the course of the study the staff of the Center for Research Libraries, especially Ray Boylan, provided much help and insight.

I would like to thank the other CLR Fellows who have been supportive colleagues. I would also like to thank Herman Fussler who's knowledge has added greatly to my understanding of research libraries and the problems of resource sharing. Barbara Holstein proofread the final draft.

STUDIES OF USE AT THE BRITISH LIBRARY LENDING DIVISION

The BLLD has conducted two comprehensive surveys of serial requests. The first in 1975[1] and the second in 1980.[2] Both studies used samples taken over short periods of time. The 1975 study included every sixth request for a three month period. In 1980 the study included all the requests from ten consecutive working days. The two studies should provide rough guides for what might be expected from the present study.

Before examining the results, the differences between the BLLD and the Center should be considered. First the BLLD is a national, and even international resource for all types of institutions. In the 1975 study universities and polytechnics accounted for only 37% of the requests. In the 1980 study academic institutions accounted for 41% of the requests. The 1975 study indicates that the academic institutions were disproportionately high users of social science and humanities titles. In the 1980 study the success rate for university requests was only 80% compared with an overall success rate of 87%. This indicates, not surprisingly, that the needs of academic institutions are different from the needs of other types of libraries. The Center, of course, serves primarily academic libraries.

The 1980 study also analyzed overseas requests. They were substantially less concentrated than the U.K. requests. For the U.K. 50% of the demand could be met by 10% of the titles. For the overseas requests 50% of the demand was meet by 22% of the titles. The overseas requests may be representative of requests

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1. Bower, C. A. "Patterns of use of the serial literature at the BLLD." BLL Review 4(2):31-36 1976.

2. Clarke, Ann. "The use of serials at the British Library Lending Division in 1980." Interlending Review 9(4):111-117 1981.

3. It is not unreasonable to assume that the requests from the Center made up about 12% of the BLLD overseas requests. In the sample period there where 7,132 overseas requests. If this is converted to an approximate annual figure, there were about 178,000 overseas requests in 1980. The Center made 23,265 requests of the BLLD in 1980, or a little more than 12% of these.

made by the Center on behalf of its members.[3]

It is clear that the BLLD results can not be applied blindly to the Center's situation, but the two studies do show patterns of interest. The most important findings were:

1. Concentration of Requests. In both studies relatively few titles accounted for a large proportion of demand. In the 1975 study 50% of the demand was met by only 1,345 titles in 1980 50% of the demand was met by 1,939 titles. These titles represented only 9% of the titles requested in 1975, and only 10% of the titles requested in 1980.

2. Subject of Requests. Both studies found that scientific and technical requests predominated. The proportions are almost identical in both studies, about 82% of the requests were scientific or technical titles, about 13% were in the social sciences and about 4% in the humanities.

3. Currency of Requests. Both studies showed a concentration of requests for current titles. In the 1975 study 57% of the requests were for items published in the previous five years. In 1980 the figure was 55%.

4. Language and Place of Publication. The 1980 study did not speak to these issues, but in 1975 87% of the requests were for items written in English, and nearly three-fifths of the requests were for titles published in North America or in the U.K.

5. Differences by Subject. Again, both studies show similar results. Scientific and technical request were concentrated in fewer titles. In 1980 50% of the demand for scientific and technical material was met by 10% of the titles. In the social sciences 50% of the demand was met by 16% of the titles, and in the humanities 50% of demand was met by 23% of the titles. Humanities requests were more likely to be for older material. In 1980 69% of the requests were for items more than five years old, as compared with 40% of the social science requests and 37% of the science requests.

6. Overlap of Most Often Requested Titles. The 1980 study compared the most often requested titles in 1980 with the most often requested titles in 1975. The results are not encouraging for those who hope to develop core collections. The overlap of the most requested 100 titles was only 60%; the overlap for the most requested 1000 titles was 56%, and for the most requested 5000 titles it was only 52%. This did not take into account title changes and the like, and may only be reflection of the short duration of the samples used in both studies. On the other hand it may show that the titles that receive heavy use change quickly; therefore, any core list will have only limited value.

A less comprehensive survey of requests to the BLLD in the social sciences was conducted in 1966.[4] At this time the BLLD had only been lending social science materials for six months, so the results must be viewed as tentative. It was found that the concentration of requests was less than in the sciences, but not markedly so, and that the date of publication range was similar to the sciences. Most interesting was the high proportion, 97%, of requests for English language material.

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4. Wood, D. N. and Bower, C. A. "The Use of Social Science Periodical Literature." Journal of Documentation 25:108-122 June 1969.

Models and Libraries

Models have not been widely used in libraries. Most often it is argued that a model can not accurately represent the complexities of the library. It is also argued that it is expensive and sometimes impossible to measure what happens in them. The response of Rao and Zunde to this arguement bares repeating:

> Modeling is very strongly motivated by the fact, often observed and verified, that, even though the system which is to be modeled may be very complicated and the output producing mechanisms very complex, the output variables in which we are primarily interested may have quite simple and usable patterns.[5]

One suspects, that political concerns and most librarians' lack of dexterity with numbers may also be partly responsible for the lack of acceptance of models. Bonner lays some of the blame on the work of operations researchers in libraries. He cites four failings:

1. The mathematical constructions in most of the models have been unnecessarily complex.

2. Not enough attention has been paid to the implementation of the models that have been developed.

3. The models are too often viewed has a product rather than as an ongoing process.

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5. Rao, V. Venkata and Zunde, Pranas. "Some Approaches to Modeling Complex Information Systems." Information Processing and Management 18(3):151-160 1982. p. 151.

4. Too few of the models have dealt with the most pressing strategic problems facing library managers.[6]

Despite these failings, Bommer is strongly endorses the value of models:

> However, it should be recognized that the process of clarifying issues, identifying relationships, exploring barriers, investigating alternatives, examining values and assessing behavioral, organizational and political ramifications of a problem can yield invaluable benefits.[7]

In the literature, studies of the use of periodical collections in all types of libraries abound, and most agree that many journals now held by libraries are not often used. King et. al. in reviewing some of these studies state:

> An important factor is that several studies suggest that a fairly large proportion of journals in libraries have fewer than five or ten uses for any given volume (about 30 percent and 45 percent, respectively). Thus if libraries had knowledge of use and made their decisions on an economic basis only, they would cancel a number of journal subscriptions.[8]

But these studies often suffer from methodological weaknesses, and so the results are not generally applied with vigor.

Some have argued that use and benefit can not be equated, thus calling into question the value of modeling. Schad in his comments on the University of Pittsburgh study is typical of this camp when he states, "In the final analysis need, not use, should determine what libraries contain."[9] This philosophical position is hard to dispute, especially as few of its proponents are able to define "need" with any precision. Many consider this

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6. Bommer, Michael. "Operations Research in Libraries: A Critical Assessment." Journal of the American Society for Information Science 26:137-139 May-June 1975.

7. Ibid. p. 138.

8. King, Donald W.; McDonald, Dennis D., and Roderer, Nancy K. Scientific Journals in the United States: Their Production, Use and Economics. Stroudsburg, Penn.: Hutchinson Ross Publishing Co., 1981. p. 142.

9. Schad, Jasper G. "Missing the Brass Ring in the Iron City." Journal of Academic Librarianship 5:60-63 May, 1979. p. 62.

argument outdated, but it is not trivial. As Burns points out, it forces us to confront the important distinction between the library's archival and service responsibilities.[10] The Center, because of its special archival responsibilities must be sensitive to this distinction. Unfortunately need, even more than use, is a slippery concept. Surveys of various sorts have been used by some libraries in attempts to measure need, but as Halperin has observed these surveys are also prone to methodological flaws.[11] Since no other measure of need has been demonstrated as practical, for now we must be satisfied with use as our measurable benefit. We must not though, allow the results of any study to force conclusions against our better judgment. As Kraft reminds us, the results of these studies should inform decision makers, not make decisions.[12]

The Cost/Benefit or Kraft Model

A number of attempts have been made to model the journal selection process. One of the two approaches that appears to have the most merit for our purposes is that put forth by Kraft[13], and Kraft and Polacsek.[14] They propose the calculation of a cost/benefit ratio for each journal in the collection and each journal being considered for selection. Journals are then ranked and selected for inclusion in the collection beginning with the title with the lowest cost/benefit ratio and continuing until the budget is exhausted. Journal

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10. Burns, Robert W., Jr. "Library Use as a Performance Measure: Its Background and Rationale." Journal of Academic Librarianship 4(1):4-11 March, 1978. p. 5.

11. Halperin, Michael. "Determining User Preferences for Information Services." Drexel Library Quarterly 17(2):88-98 Spring, 1981.

12. Kraft, Donald H. "Journal Selection Models: Past and Present." Collection Management 3(2/3):163-185 Summer/Fall 1979. p. 176-177.

13. Ibid.

14. Kraft, Donald H. and Polacsek A. "A Journal-Worth Measure for a Journal-Selection Decision Model." Collection Management 2(2):129-139 Summer 1978.

selection thus becomes a variation of the "knapsack problem". Benefit in their model is calculated as the weighted sum of three factors, usage, relevance and availability elsewhere. Recognizing the difficulties in determining use, they suggest that surrogate measures such as citation or appearance in online searches might be substituted. The term "relevance" is used as a catchall for subjective factors, such as the opinions of faculty or librarians. They suggest that the weighting of the factors be left to the individual library. A more rigorous treatment of the same general approach is presented by Kraft and Hill.[15] They present the problem as a integer program and introduce a number of additional constraints into the analysis. Holland claims to have used a simple version of this approach with use of current issues as the benefit measure.[16]

The effectiveness of this approach has been demonstrated on a limited scale by Robertson and Hensman.[17] They compared the results of selecting journal titles in the area of biodeterioration using a Bradford distribution, using a ranking by precision (the number of relevant items in a title divided by the total number of items in that title) and using a ranking by cost-effectiveness (the number of relevant items in a title divided by the cost of acquiring that title). They posed two tests. First, which method selects 90% of the relevant titles at the lowest price? Second, which method will least reduce the number of relevant titles given a 10% reduction in expenditures? In both cases the cost-effectiveness ranking out performed the others. Although Robertson and Hensman are careful to point out that their results should be viewed cautiously until they are verified in other areas, none the less their findings lend support to this approach.

Despite this support, the Kraft model has a number of problems. It appears that it should be easily applied, but this is not the case. Before doing so it is necessary to operationalize the definitions of use and relevance, and define a weighting system. Goehlert attempted this type of analysis in a collection of political science journals, and suggests that use

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15. Kraft, D. H. and Hill, T. W., Jr. "A Journal Selection Model and Its Implications for a Library System." Information Storage and Retrieval 9:1-11 1973.

16. Holland, Maurita Peterson. "Machine-Readable Files for Serials Management: An Optimizing Program and Use Data." College and Research Libraries 44(1):66-69 January 1983.

17. Robertson, S. E. and Hensman, Sandy. "Journal Acquisition by Libraries: Scatter and Cost-Effectiveness. Journal of Documentation 31(4):273-282 December, 1975.

can be defined as either the total number of requests or the number of users.[18] The Center, because it is a membership organization, must consider this question. It is not clear whether many uses for one member is more or less valuable than fewer uses for a number of libraries. This demonstrates the opportunity for the introduction of arbitrary factors which may limit the value of the model. The model also assumes that the benefit (use) provided by a journal in one period will correspond to the benefit provided in some future period. This assumption may be true, but it has not been proven. In fact some evidence, most notably the overlap study at the BLLD, points in the opposite direction.[19] In our application of the Kraft model, we will reduce the measure of benefit to actual use. Having done this, we must be able to predict the expected level of use of a given journal title. We will consider possible predictors of future use below.

The Combined Measures of Use or Dhawan-Phull-Jain Model

Another model which may have some application is presented by Dhawan, Phull and Jain.[20] They do not consider cost, but rather suggest combining three measures, citation in the primary literature, citation in the secondary literature (indexes and abstracts) and use as observed in journal use studies. They argue that each of these measures is in its own way flawed, but that combining the measures will provide an effective tool for making journal acquisition decisions. They suggest the following priorities among titles:

1. Journals which are cited, abstracted and used.

2. Journals which are abstracted and used, but not cited.

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18. Goehlert, Robert. "Journal Use per Monetary Unit: A Reanalysis of Use Data." Library Acquisitions: Practice and Theory 3(2):91-98 1979.

19. Clarke, Ann. 1981. p. 112-113., and Kefford, Brian and Line, Maurice. "Core Collection of Journals for National Interlending Purposes." Interlending Review 10:35-43 1982. p. 39-40.

20. Dhawan, S. M., Phull, S. K. and Jain, S. P. "Selection of Scientific Journals: A Model." Journal of Documentation 36(1):24-34 March, 1980.

(Included in this class would be news, popular and applied titles.)

3. Journals which are cited and used, but not abstracted. (Included in this class, they claim, are locally produced materials and the like.)

4. Journals which are used, but neither abstracted nor cited.

5. Journals which are abstracted and cited, but not used.

This approach is also interesting because they are concerned with defining the class a title falls into and not in developing ranked lists. They care only that a title obtain a minimum level of use to be considered used in terms of one or more of the measures. Dhawan, Phull and Jain supply no empirical support for their priorities, and their model does not allow for cost/benefit analysis because it treats journals as members of groups rather than as individuals. Despite this, it needs to be considered as a possible framework for journal acquisition decisions. We need to determine if the combination of measures will prove to be an efficient predictor of future use.

Selection of Categories Versus Individual Titles

The two models discussed above attempt to identify individual journal titles to be added to a collection. Line has argued that for a central resource, such as the Center, this is not the most appropriate approach. He states, "It is desirable... to think in terms of categories of material rather than individual items. This makes not only selection but the allocation of provision between the centralized and the co-operative system much easier."[21] Line offers no empirical evidence to support his view, but given his position as Director General of the BLLD it must be taken seriously.

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21. Line, Maurice B., "Criteria for Selecting Material for a Central Lending Stock." Interlending Review 7(4):126-129. p. 126.

One advantage of this approach is that it could dovetail with other nation collection development efforts such as that of the Research Libraries Group (RLG).[22] Lesnik claims that at least in the area of South Asian materials this is the policy RLG has adopted.[23] In fact much of the Center's collection development to date has been based on this premise. Examples of collections of this sort include foreign doctoral dissertations, Russian science journals, and the recent expansion of the collection of Japanese science journals.

While this approach will likely not lead to the optimal solution in the testing of alternative models, it provides a context that may allow for more effective resource sharing, and thus ultimately may lead to the more effective utilization of the Center's collection. This approach will also likely find support in the research library community. As the Center is a membership organization, this is no small advantage.

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22. For a description of RLG's program see; Gwinn, Nancy E. and Mosher, Paul H. "Coordinating Collection Development: The RLG Conspectus." College and Research Libraries 44(2):128-140 March 1983. It is interesting and somewhat distressing that no mention of the Center is made in this article.

23. Lesnik, Pauline Tina. "The Research Libraries Group's Program for South Asia." Library Acquitions: Practice and Theory 6:233-239 1982. p. 234.

PREDICTORS OF FUTURE USE

The substitution of various surrogate measures for use have been suggested. It is with these various surrogates that we will begin our search for predictors of future use.

Citation.

Of all the surrogates, citation has received the most attention. Beginning in 1927 with the Gross and Gross study, citation has been applied to the journal selection process.[24] The prime appeal of citation is that in some broad sense, it is the scholarly recognition of use. This has at least two problems. First, as Garfield has shown, there is a lack of standard citation practice across disciplines.[25] This calls into question citation comparisons from one field to another. These are the type of comparisons that would be most useful in building multidisciplinary collections. Secondly, the most available source of citation information, the Institute for Scientific Information (ISI) database, is comprehensive, while most library collections are not. Thus the application of the ISI data may be inappropriate for many libraries. Line in particular has been critical of the use of citation data for this reason.[26] The opposite has also been argued. Watts chides the ISI database for its parochialism, claiming that it does not adequately represent non-English publications.[27]

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24. Gross, P. L. K. and Gross E. M. "College Libraries and Chemical Education." Science 66:385-389 October 28, 1927.

25. Garfield, Eugene. "Significant Journals of Science." Nature 264:609-615 December 16, 1976. p. 609.

26. Line, Maurice B. "Rank Lists Based on Citation and Library Uses as Indicators of Journal Usage in Individual Libraries." Collection Management 2(4):313-316 Winter, 1978. p. 315.

27. Watts, George T. "The Case Against the Citation Index." (letter) Lancet No. 8328 April 9,1983. p. 826.

Despite the wealth of theoretical work and Garfield's protestations,[28] the relationship between citation and use has yet to be convincingly established, at least to the satisfaction of most practicing librarians. As Line and Sandison have pointed out, many citation studies are based on inadequate samples and do not provide data that is useful for library decision making.[29] Perhaps, the most damaging evidence comes from Scales. She correlated citation as reported by ISI with use at the BLLD. She found a low correlation between use and both gross citation counts and impact factors.[30] Pan has suggested that Scales data may not apply to smaller libraries, but it is likely to coincide with the the Center, which like BLLD serves as a national resource.[31] Rice found that use of science periodicals in a university library and citation as reported by ISI were not highly correlated.[32] In a reworking of Rice's data, Stankus and Rice found that use was correlated with neither gross citation counts nor impact factor. They found that the results varied by discipline, and that the correlations were highest with low use titles.[33]

While the results are far from conclusive, the bulk of the evidence suggests the citation must be included in any list of possible predictors of use. As Broadus says after his extensive review of the citation literature, "In the absence of highly expert subject specialists on a library staff, citation studies

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28. See for example, Garfield, Eugene. "Citation Analysis as a Tool in Journal Evaluation." Science 178:471-479 November 3, 1972.

29. Line, Maurice B. and Sandison, Alexander. "Practical Interpretation of Citation and Library Use Studies." College and Research Libraries 36:393-396 September 1975.

30. Scales, Pauline A. "Citation Analyses as Indicators of the Use of Serials: A Comparison of Ranked Title Lists Produced by Citation Counting and from Use Data." Journal of Documentation 32(1):17-25 March, 1976.

31. Pan, Elizabeth. "Journal Citation as a Predictor of Journal Usage in Libraries." Collection Management 2(1):29-38 Spring, 1978.

32. Rice, Barbara A. "Science Periodicals Use Study." Serials Librarian 4(1):35-47 Fall, 1979.

33. Sankus, Tony and Rice, Barbara. "Handle With Care: Use and Citation Data for Science Journal Management." Collection Management 4(1/2):95-110 Spring/Summer, 1982.

can be of considerable value in choosing serials and even monographs.... Citation studies do hold some hope for improving the quality of selection."[34] Or, as Smith states:

> Small differences in citation counts should not be interpreted as significant, but large differences may be interpreted as reflections of differences in quality and impact. Results of citation counts for should be compared with alternative quality indicators to look for correlations. The validity of the measure is most fragile in citation counts for individual documents and authors. One can have more confidence in comparisons of counts based on larger units, such as journals.[35]

Past Use.

At least since the Fussler and Simon study of use at the University of Chicago in the late 1950's, past use has been considered one of the best predictors of future use.[36] Urquhart and Urquhart reached similar conclusions based on a study at the University at Newcastle. They also found that use at the BLLD was a better predictor than use at a local library or the opinions of researchers.[37] It should be noted, however, that in both of these cases the concern was for identifying titles receiving little use. It is not as clear that because lack of use in the past predicts lack of use in the future, that past use will predict future use. Using the Fussler and Simon data,[38] we see that biology periodicals show that the

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34. Broadus, Robert N. "The Application of Citation Analyses to Library Collection Building." in Advances in Librarianship. 7:299-335 1977. p. 328.

35. Smith, Linda C. "Citation Analysis." Library Trends 30(1):83-106. p. 88.

36. Fussler, Herman H. and Simon, Julian L. Patterns in the Use of Books in Large Research Libraries. rev. ed. Chicago: University of Chicago Press, 1969. p. 93-106.

37. Urquhart, J. A. and Urquhart, N. C. Religation and Stock Control in Libraries. London: Oriel Press, 1976. p. 123-127.

38. Fussler, Herman H. and Simon, Julian L. 1969. p. 94.

probability of no use in one volume given no use in the pervious volume was 0.85; the probability of use given use was 0.66. With periodicals in the teutonic languages the probability of no future use given no previous use was 0.94; the probability of future use given past use, however, was only 0.46.

Age

A number of studies have attempted to describe the obsolescence of materials, especially in the sciences where the intuitive case for the lessening of usefulness with time is strongest. Despite this work there are few conclusive results. As Gapen and Milner state at the end of their review:

> "In conclusion, while the practical results of the obsolescence research done to date are of little value or use in daily library operations, many of the points under consideration are vital to ensuring the viability of library operations and are worthy of new consideration." [39]

Part of the problem in dealing with obsolescence is that the effect is confounded by the growth of the literature. For example, Chen in a study of physics journals claimed that there was a clear trend of declining use for older material.[40] Sandison later reworked the Chen data accounting for the growth of the literature and claimed the there was no decline in use with age.[41] Countering Sandison's claim is a study by

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39. Gapen, D. Kaye and Milner, Sigrid P. "Obsolescence." Library Trends 30(1):107-124 Summer, 1981. p.123.

40. Chen, Ching-Chin. "The Use Patterns of Physics Journals in a Large Academic Research Library." Journal of the American Society for Information Science 23(3):254-270 July/August, 1972.

41. Sandison, Alexander. "Densities of Use, and Absence of Obsolescence, in Physics Journals at M I T." Journal of the American Society for Information Science 25(2):172-178 May/June, 1974.

Sullivan, et. al. which took growth into account and still found an obsolescence effect.[42]

While the question of obsolescence is of theoretical interest, it is less central for the Center and for this project. Because of its archival responsibilities the Center is not concerned with weeding its collections, and weeding collections has been the prime application of the obsolescence research. The only application of obsolescence for this project would be in the selection of backfiles. Given the vagaries of the research and the difficulties of data collection this will not be considered.

Online Search and SDI Results.

Drott examined another possible surrogate for use, online literature searches, and found that the variability of the results called the method into question.[43] On the other hand, Danilowicz and Szarski found that the monitoring of an SDI system provided results that where highly correlated with the opinions of experts.[44] They thus concluded that the monitoring of such a system would be useful in journal selection. Even if there was no ambiguity in the research, this type of measure would not be particularly useful to the Center unless a list of titles retrieved were available on a comprehensive bases, perhaps from one of the online vendors. At this time no such lists are easily obtainable.

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42. Sullivan, Michael V.; Vadeboncoer, Betty; Shiotani, Nancy and Stangl, Peter. "Obsolescence in Biomedical Journals: Not an Artifact of Literature Growth." Library Research 2:29-46 1980/1981.

43. Drott, M. Carl. "Selecting Journals Based on Search Results: A Study of Variability." in The Information Age in Perspective: Proceedings of the ASIS Annual Meeting. Volume 15. Compiled by Everett H. Brenner. White Plains, N.Y.: Knowledge Industry Publications, Inc, 1978. Pages 112-114.

44. Danilowicz, Czaslaw and Szarski, Henryk. "Selection of Scientific Journals Based on the Data Obtained from an Information Service System." Information Processing and Management 17:13-19 1981.

Citation in Indexes or Abstracts.

Citation in secondary sources is one of the measures of use suggested by Dhawan, Phull and Jain.[45] It was also one of the prime criteria used by Urquhart when building the initial collection of the BLLD.[46] Indexing is clearly related to the citation in both online searches and an SDI system and may show promise for the same reasons.

There are two approaches. First the number of times a journal title appears in a given index or abstract can be counted. If these counts were supplied by the publishers of the major indexing and abstracting services they would be well worth investigation, but they are not. The second alternative is to count the number of indexes or abstracts that cover a given title. This information is available in an incomplete form in Ulrich's.

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45. Dhawan, S. M., Phull, S. K. and Jain, S. P. 1980.

46. Urquhart, Donald. Principles of Librarianship. Metuchen, N.J.: Scarecrow Press, 1981. p. 33.

Other Demographic Factors.

We need to consider some demographic factors that, although they may not be good predictors alone, may enable us to refine the prediction made with some of the more significant measures. In fact, some of these factors may predict with surprising power. Pan found that the number of subscriptions and the number of articles published were good indicators of use.[47] The latter conclusion is disputed by Boyce and Pollens, though their methodology seems questionable.[48]

Such factors would include language, place of publication, subject, number of subscriptions, and cost. In general this information is available. Cost is of concern both as a possible predictor of use -- it may be that libraries will request items from the Center that they can not afford to purchase -- and as a necessary component of cost-benefit considerations. Language and place of publication are of importance if a categorical rather than a title by title approach is taken. We may, for example, wish to consider the effect of only purchasing English language titles published in non-English speaking countries.

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47. Pan, Elizabeth. 1978. p. 32.

48. Boyce, Bert R. and Pollens, Janet Sue. "Citation-Based Impact Measures and the Bradfordian Selection Criteria." Collection Management 4(3):29-36.

METHODOLOGY OF THE STUDY

Background and Purpose

The Center has a major advantage in journal selection modeling. Use can be measured. Records of both requests filled from the Center's collections and those unfilled are available, as are requests which the Center made to the BLLD on behalf of its members. Since these requests represent virtually all of the use of the Center's collections, it is a straight forward, if time consuming, task to establish the use received by any given title, and that title's unmet demand.[49] This is a unique situation; few other libraries have comprehensive records of use over long periods of time. Most previous studies have measured cross-sections of use, few have been able to look at use over time.

This advantage might imply that the formulation of a journal selection model for the Center is an easy matter. Unfortunately, this is not quite the case. The model needs to be predictive. Even though it is possible for the Center to measure the use of its journal collection, it can not do so before the fact. It is therefore necessary to develop reliable predictors for use of a given journal. If such predictors are found, we can use the Kraft model or some variant to make reasoned judgments about the most effective use of available resources. In an ongoing system the value of the predictors could easily be monitored and adjusted. The trick is to develop the predictors and to establish their validity.

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49. At the present time none of the Center's use records are in machine-readable form. This means that one must conduct studies such as this one by hand, usually using samples. It would be a major advantage if the use at the Center was more easily measured. It is recommended that the Center move toward this capability.

Another complication is political. The Center is a membership organization; therefore the programs it developes must not only effective and meet the needs of the membership, but also must be those that the membership perceives as being appropriate to the Center. The political issues are not the concern of this study, but they are always in the background.

In this study we will begin by selecting a sample of titles from Ulrich's for a base year, 1977. The demographic factors listed below will then be established for each title, as well as the use of that title by the Center in JAS from September 1977 to July 1982. In July of 1982 the Center began to charge for JAS; since the charges undoubtably affected use, we will not include data collected after they were imposed.

The study will attempt a number of approaches to developing a journal selection policy for the Center.

1. We will examine the characteristics of the sample and the way these characteristics change, considering only the subsets that include those titles used one or more times and those used five or more times.

2. The correlations between use in the different periods of the study will be examined to determine how effectively past use predicts future use.

3. We will attempt to develop predictors of use through regression techniques. These predictors will then be applied to the Kraft model to test their effectiveness.

4. The Dhawan-Phull-Jain model of journal selection will be tested. Again the primary tool will be regression.

5. The category approach will be tested. We will both look at the effectiveness of this approach versus a title by title approach and also attempt to determine the most effective strategy if this approach was adopted. For this analysis the various strategies of journal collection represented by subsets of the sample will be compared

Variables for the Study

We will consider the following variables for each title:

1. Use made of the titles in JAS, both the uses filled by the Center and those filled by BLLD, in the following periods as documented in the Center's transaction records:

   a. September - December 1977
   b. 1978
   c. January - June 1979
   d. July 1979 - June 1980
   e. July - December 1980
   f. 1981
   g. January - June 1982

2. Number of different member institutions making the requests for a title. Due to the way the records of requests have been kept at the Center it was convenient to do this only for the year 1979/80.

3. Number of citations to the title in the base period. This information will be taken from the ISI database.

4. Impact factor for the title. Again taken from the ISI database.

5. Language in which the journal is written.

6. Country of publication.

7. Availability of indexing for the title. This information will be taken from Ulrich's and therefore is subject to question. While probably not complete, it is all that is easily available.

8. Cost of the title. This is the 1977 Ulrich's figure.

9. Number of subscriptions as reported by Ulrich's.

10. The subject of the journal by Dewey classification as given by Ulrich's.

11. Holdings of the titles. This was taken from the OCLC

database in late March 1983. (See Appendix One for a discussion of the use of OCLC holdings as a surrogate for national holdings.)

12. The Center's holdings of the title.

Obtaining the Sample and Collecting the Data

Ulrich's as a Sample Universe. To establish the viability of Ulrich's as a universe from which to draw the sample of journals for the study. A systematic sample of 135 titles requested by the Center from the BLLD in the first three months of 1982 were checked against the 1982 edition of Ulrich's.[50] Of these titles 102 or 75.5% were found in Ulrich's.[51] The titles not found in Ulrich's were checked in Irregulars and Annuals, in New Serials Titles, 1950 to 1980, in Union List of Serials, and in CASSI. This search resulted in the verification of 21 of the titles or 15.5% of the sample. The remaining 12 titles or 8.9% were not located. It was not possible to determine which of the titles verified in sources other that Ulrich's were no longer live titles, but some were found to be dead. If we exclude the titles that could not be verified, the percentage of the sample found in Ulrich's increases to 82.9%. At least some of the titles not found could not be located because they were bad citations or similar mistakes. These results, while they do not demonstrate the value of Ulrich's as a universe, to the extent that we might wish, do suggest that Ulrich's may be acceptable. Even though

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50. Since those titles which were requested more that once were more likely to be included in the sample than titles requested only once, this sample was not truly a random sample. This bias is not considered significant. As part of a project to make additions to their periodical collection, the Center has checked this file to identify often requested titles and found that only 16 titles were used by six or more institutions, and of these the title with the most use received only 31 requests. The total number of requests in this period is probably in excess of 4,000. While the bias is likely not significant it clearly exists; of the 16 titles identified by the Center as often requested titles, two found their way into our sample. This is beyond what we would expect from a truly random sample.

51. These figures have an interval of about 7% at a 95% level of confidence.

Ulrich's is not a complete universe, it can be argued that it is still appropriate for three reasons:

1. It includes over 75% of the titles that we might expect to be requested from the Center.

2. There is no reason to believe that the titles not included in the Ulrich's sample should behave in ways different from the titles in the sample.

3. These are the titles that the Center will find it easiest to acquire.

For these reasons the Ulrich's sample was used.

Sampling from Ulrich's. Having chosen Ulrich's as the universe, a sample of 1010 titles was selected from the 1976/77 Ulrich's (17th edition). The year 1977 was chosen as the base year because it is the first year that ISI published citation information from the Social Sciences Citation Index. The sampling procedure was systematic. The sample did not include sections of Ulrich's containing subjects that are out of the scope of the JAS program, (for example, abstracts or journals in clinical medicine or the humanities). With these subjects removed there are about 1250 pages of titles. The sample included the bottom title from the second column of all but a randomly selected 250 pages of relevant subjects.

Collection of Additional Data During the pass through Ulrich's, in addition to selecting and recording the titles, ISSN's, language and place of publication, cost, indexing, subscription information, and Dewey subjects were recorded.

Citation information for the sample titles was obtained from the 1977 editions of the Journal Citation Reports for the Science Citation Index and the Social Sciences Citation Index.

The records of the requests sent to the BLLD were checked to establish the total number of requests for the sample titles. This data is in monthly files from September 1977 to July 1979. The requests for July 1979 to June 1980 were in one alphabet. From July 1980 to the present the files are kept quarterly.

For 1979/80, both the total number of requests and the number of institutions making those requests were recorded.

Holdings information was collected from the OCLC database. Searching was done using both title, corporate author and ISSN search keys. The searching was done during March 1983.

To establish the Center's holdings its shelflist was checked.

Recording of the Data

The data was originally recorded on file cards. In was then coded and keyed into the University of Chicago computer system. The statistical package SAS performed the statistical manipulations.

Analysis of the Data

1. Regression techniques were used to determine what factors, if any, can predict use in the later periods. Hodowanec used a similar technique to attempt the prediction of the use of books and periodicals in a university library in order to develop an allocation formula.[52] His results, despite the differences in the environment of the study, were not encouraging. His multiple regression analysis found that the three independent variables he identified accounted for only 31% of the variance in his dependent variable use. Even if it is not possible to develop predictors with sufficient certainty to build a good model, this analysis should point toward areas that can be more profitably developed.

2. The Kraft model will be tested using regression techniques.

3. The effectiveness of the Dhawan-Phull-Jain model will be tested. This will be done by developing a dummy variable to represent their hierarchy and using it in regressions against use and holdings in OCLC.

4. The merit and relative effectiveness of various strategies of categorical selection will be examined by assuming the category had been acquired in 1977 and seeing what proportion

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52. Hodowanec, George V. "Analysis of Variables Which Help to Predict Book and Periodical Use." Library Acquisitions: Practice and Theory 4(1):75-85 1980.

of the demand in the next five years it could have filled. The results will be compared to the full sample, which would represent random selection and other strategies of categorical acquisition. Use per title, cost per use, percentage of titles in the category used, and the mean number of holdings for the category will be used to judge the effectiveness of the various strategies.

RESULTS

In looking at the results of this study one thing stands out above all else: there are few simple dominate trends. The data does suggest directions, but those directions are not as compelling as one might wish. We believe this points to the complexity of journal use, especially in the research library environment. All too often in the discussion of journals, especially in a resource sharing context, titles are divided into two broad classes, the well-known and the obscure. We tend to think in terms of Nature and the Australian National Drycleaner. This study demonstrates that such a simplistic view can not be supported. It is not so clean an issue. Despite this, we can draw some important conclusions. However, we should note at the beginning that the results must be interpreted with intelligence. The data suggests directions, not quick fixes.

We must also consider the position of the Center as a national resource. It is subject to contradictory pressures in developing its journal collection. It should collect titles that are not frequently held, but at the same time they should be of scholarly value and should receive some, though not necessarily extensive use. In fact, it is not clear to some that CRL should be involved in collecting journals at all. If no journals exist that meet the criteria suggested above this view would seem to be correct. If on the other hand infrequently held but used titles can be identified, then CRL's involvement in journals would seem to be justified.

It should also be clear at the outset that this study looks at the use of titles, not at transactions. Its primary goal is to identify those journals that would provide the most value to the Center. In this context one of the major limitations of the study should be noted. It was not possible to examine which institutions were making use of JAS. This is an important political issue for the Center, but one upon which this study cannot shed light. A second, though less critical limitation is that the study did not consider the publication dates of the requests. This is less significant as JAS includes only post-1970 requests, and it can be assumed that the date range of the requests is similar to that in other studies, especially those at the BLLD.

CHARACTERISTICS OF THE SAMPLE

This section considers the characteristics of the sample and examines how these characteristics change when the sample is limited to titles used one or more times, and when it is limited to those titles used five or more times.

General Characteristics

The 1010 titles in the sample were used on average 2.3 times. However, this is a deceptive figure; use ranged from no use to 90 uses per title, with a standard deviation of 7.3. This indicates a wide variance in the number of uses the sample titles received. In fact, only 27.1% of the titles were uses at all. The mean number of holdings per title, as indicated by OCLC, was 18.5, but again this is a deceptive figure. The standard deviation was 46.6 and the range of holdings was none to 549. Almost 40% of the sample titles showed no OCLC holdings. The average price for a title (in 1977 dollars) was $22.11 and the mean subscribtions was just over 25,000. But again the variances, as indicated by high standard deviations and large ranges is clear. Surprisingly only 6.2% of the sample titles were cited and only 25.5% were indexed. For our purposes this information while interesting, is of little value. It is not such aggregate figures, but the dissection of the sample into classes of titles that will provide the most value in this analysis. (These and other summary values are shown in Table One.)

Table One
Summary of Numeric Variables

Variable	Number	Mean	Std. Dev.	Range
Indexing	1010	0.6	1.2	0 - 10
Citation	1010	42.2	323.2	0 - 5360
Impact	1010	0.04	0.27	0 - 4.2
Holdings (OCLC)	1010	18.5	46.6	0 - 549
Total Use	1010	2.3	7.3	0 - 90
Price	871	$22.11	$44.89	0 - $627
Subscriptions (in '000s)	648	25.2	140.6	0.1 - 2400
Total Uses	1010	2.3	7.3	0 - 90

	Number Titles	% of Total Sample
Indexed	258	25.5%
Cited	63	6.2%
Used	282	27.9%

Concentration of Requests

The concentration of requests follows patterns that are familiar.[53] (See Table Two.) It this case the typical 80/20 rule is exceeded. It takes only 12%, or about 130 of the titles to supply over 85% of the uses. Half of the use is supplied by 33 titles, or only a little over 3% of the sample.

Again this information is unsignificance without identifying which of these titles are heavily used. Figure One sheds some light on this issue. Here we have plotted titles in descending order of OCLC holdings and the use that the title received in JAS. What we see is that most titles with over 100 holdings were used between one and ten times, but few are used more often. While this likely represents illegitimate use of JAS, it more importantly shows that the use of JAS does not follow the generally accepted pattern.[54] The most active titles generally have between 10 and 50 holdings. Some titles held less than 10 times were used, but many were not used at all. Some of the same trends can be seen in Table Three, but it should be noted that this shows only the percentage of titles in a group that are used, and not the extent of that use.

Before jumping to any conclusions of the basis of this data we need to carefully consider it in light of the nature of the sample. We should recall that the sample was a randomly chosen sample for Ulrich's representing all of the world's journals output. We would expect many, if not most, of these titles to be of little value to the research library community. The finding that only 27.9% of the titles showed any use in five years

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53. See the BLLD studies or Trueswell, Richard W. "Growing Libraries: Who Needs Them? A Statistical Basis for the No-Growth Collection." in Gore, Daniel, ed. Farewell to Alexandria: Solutions to Space, Growth and Performance Problems of Libraries. Westport, Conn.: Greenwood Press, 1976. p. 72-104.

54. For example the ACM Periodical Bank reported heavy use of the most widely held titles. Stewart, Blair. "Optimum Size for Periodical Collections in Liberal Arts College Libraries." in Gore, Daniel, ed. Farewell to Alexandria: Solutions to Space, Growth and Performance Problems of Libraries. Westport, Conn.: Greenwood Press, 1976. p. 105-121. p. 111-113.

confirms this expectation. More importantly many infrequently held titles showed some use, especially if the definition of infrequently held is allowed to include titles with up to 25 holdings.

Table Two
Titles and the Percentage of Use Supplied

Uses per Title	Number of Titles	Percent of Titles	Number of Uses	Percent of Uses
50 - 90	5	0.4%	345	14.9%
25 - 49	18	1.9%	588	25.3%
15 - 24	20	2.0%	387	16.7%
10 - 14	26	2.6%	294	12.7%
5 - 9	60	5.9%	398	17.1%
1 - 4	153	15.1%	309	13.3%
All Used Titles	282	27.9%	2321	100.0%
Unused Titles	728	72.1%		

Table Three
Holdings (in OCLC) by Category of Use

Number of Times Indexed	Full Sample		Used One or More		Used Five or More	
	No. of Titles	Col. %	No. of Titles	Col. % (Row %)	No. of Titles	Col. % (Row %)
None	388	38.4%	30	10.6% (7.7%)	7	5.4% (1.8%)
1 - 2	156	15.4%	21	7.4% (13.5%)	8	6.2% (5.1%)
3 - 5	90	8.9%	19	6.7% (21.1%)	7	5.4% (7.8%)
6 - 10	100	9.9%	34	12.1% (34.0%)	16	12.4% (16.0%)
11 - 25	114	11.3%	57	20.2% (50.0%)	27	20.9% (23.7%)
26 - 50	52	5.2%	35	12.4% (67.3%)	21	16.3% (40.4%)
51 - 100	57	5.6%	46	16.3% (80.1%)	23	17.8% (40.4%)
101 or More	53	5.3%	40	14.2% (75.5%)	20	15.5% (37.7%)
TOTALS	1010		282	(27.9%)	129	(12.8%)

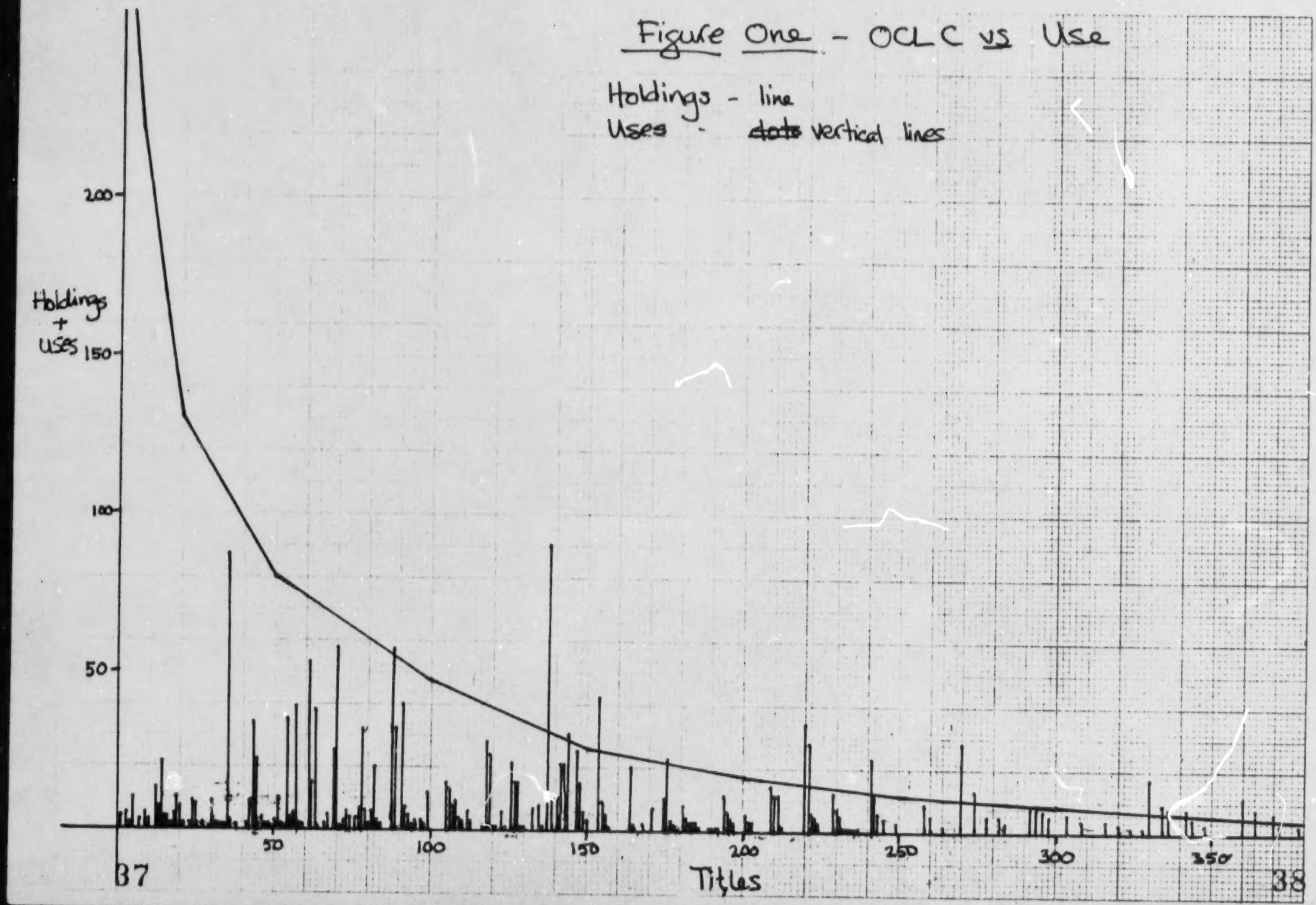
Figure One - OCLC vs Use
Holdings - line
Uses - ~~dots~~ vertical lines
Holdings + Uses
200
150
100
50
50
100
150
200
250
300
350
Titles

Place of Publication, Language and Subject of Titles

We begin the search for the indicators of more frequently used titles by looking at three significant categorical variables. (See Tables Four, Five and Six.) Here it is useful to look at those classes of titles which are disproportionately represented in the group of used titles.

When we look at place of publication we see, as in the BLLD studies, that North American and United Kingdom publications make up a large proportion (50%) of the titles receiving use. The countries that show disproportionate use are the United Kingdom, the Netherlands and the U.S.S.R. Japan and Eastern Europe show a less marked tendency in this direction. The most common language of the used titles, again as in the BLLd studies, is English. Over 70% of the used titles were in English. Russian titles and those published in English and some other language are disproportionately used. Interestingly Japanese is disproportionately represented in the titles used one or more times, but not in the five or more uses class. We should remember that these figures represent only some use and do not represent the extent of use. Also in most cases the sample size is small and must therefore be viewed cautiously.

Given these caveats we might draw a number of tentative conclusions. The use of the British and Dutch titles indicates that some users of JAS were availing themselves of titles that would probably not be considered suitable materials for the Center by some of its larger members. It is also interesting to speculate about the use of Russian materials. Are they used in JAS because of the known involvement of the Center in Russian materials or is this truly an area of need that can not be met elsewhere?

In the examination of the subjects of the titles that were used the most striking result is the percentage of science titles that receive use. It is likely that most titles that are classified as science are of more scholarly. Technology, where we might expect similar use, includes many trade journals of little scholarly value. (The Australian National Drycleaner is one such title.) So while many of the titles that are used, over 30% in both the one or more and the five or more categories, are classified as technology we can not guarantee a useful collection simply by selecting as much as we can in technology. We will need additional indicators of quality to assure that titles collected are those which will provide the most value. Social Science titles show a similar tendency.

The Dewey 100's show surprising use. Since the humanities titles, which make up most of this class, were removed from or sample and since there a only nine of these titles we will leave this finding as an unexplained anomaly.

Table Four
Place of Publication by Category of Use

Place of Publication	Full Sample		Used One or More		Used Five or More	
	No. of Titles	Col. %	No. of Titles	Col. % (Row %)	No. of Titles	Col. % (Row %)
United States	338	33.5%	87	30.9% (25.7%)	35	27.1% (10.4%)
Canada	34	3.4%	11	3.9% (32.4%)	5	3.9% (14.7%)
Total North America	372	36.0%	98	34.8 (26.3%)	40	31.0% (10.8%)
United Kingdom	92	9.1%	43	15.2% (46.7%)	25	19.4% (27.2%)
West Germany	68	6.7%	15	5.3% (22.1%)	7	5.4% (10.3%)
France	39	3.9%	10	3.5% (25.6%)	5	3.9% (12.8%)
Netherlands	33	3.3%	15	5.3% (45.5%)	7	5.4% (21.2%)
Italy	47	4.6%	7	2.5% (14.9%)	4	3.1% (8.5%)
Scandinavia	37	3.7%	5	1.8% (13.5%)	4	3.1% (10.8%)
Other Western Europe	45	4.5%	12	4.3% (26.7%)	4	3.1% (8.9%)
Total Western Europe	361	35.7%	107	37.9% (29.6%)	56	43.4% (15.5%)
U.S.S.R.	18	1.9%	12	4.3% (66.7%)	9	7.0% (50.0%)
Other Eastern Europe	53	5.2%	21	7.4% (39.6%)	8	6.2% (15.1%)
Total Eastern Europe	71	7.0%	33	11.7% (46.5%)	17	13.2% (23.9%)

(Continued)

Table Four
Place of Publication by Category of Use
(Continued)

Place of Publication	Full Sample		Used One or More		Used Five or More	
	No. of Titles	Col. %	No. of Titles	Col. % (Row %)	No. of Titles	Col. % (Row %)
Japan	28	2.8%	10	3.5% (35.7%)	3	2.3% (10.7%)
India & Pakistan	33	3.3%	10	3.5% (30.3%)	6	4.7% (18.2%)
Australia	30	3.0%	7	2.5% (23.3%)	2	1.6% (6.7%)
Other Asia	31	3.1%	6	2.1% (19.4%)	2	1.6% (6.5%)
Total Asia	122	12.1%	33	11.7% (27.0%)	13	10.1% (10.7%)
Latin and South America	39	3.9%	4	1.4% (10.3%)	1	0.8% (2.6%)
Africa	31	3.1%	4	1.4% (12.9%)	2	1.6% (6.5%)
Other	14	1.4%	3	1.1% (21.3%)	0	0.0% (0.0%)
TOTALS	1010		282	(27.9%)	129	(12.8%)

Table Five
Language by Category of Use

Language	Full Sample		Used One or More		Used Five or More	
	No. of Titles	Col. %	No. of Titles	Col. % (Row %)	No. of Titles	Col. % (Row %)
English	585	57.9%	177	62.3% (30.3%)	84	65.1% (14.4%)
English and Other	64	6.3%	32	11.3% (50.05)	19	14.7% (29.7%)
Total English	649	66.2%	209	73.6% (32.2%)	103	79.8% (15.8%)
French	45	4.5%	10	3.5% (22.2%)	5	3.9% (11.1%)
German	72	7.1%	13	4.6% (18.1%)	4	3.1% (5.6%)
Spanish	41	4.1%	4	1.4% (9.8%)	0	0.0% (0.0%)
Italian	42	4.2%	5	1.8% (11.9%)	2	1.6% (4.8%)
Russian	21	2.1%	12	4.2% (57.1%)	9	7.0% (42.9%)
Other European	109	10.8%	21	7.4% (19.3%)	4	3.1% (3.7%)
Japanese	16	1.6%	6	2.1% (37.5%)	1	0.8% (6.3%)
Other	13	1.3%	2	0.7% (15.4%)	1	0.8% (7.7%)
TOTALS	1010		282	(27.9%)	129	(12.8%)

Table Six
Subject by Category of Use

Subject (Dewey Number)	Full Sample		Used One or More		Used Five or More	
	No. of Titles	Col. %	No. of Titles	Col. % (Row %)	No. of Titles	Col. % (Row %)
000's	62	6.1%	13	4.4% (21.0%)	6	4.7% (9.7%)
100's	9	0.9%	6	2.0% (66.7%)	4	3.1% (44.4%)
200's	3	0.3%	0	0.0 (0.0%)	0	0.0% (0.0%)
300's	373	36.9%	70	29.5% (18.8%)	23	17.8% (6.7%)
400's	16	1.6%	5	1.7% (31.3%)	1	0.8% (6.3%)
500's	113	11.2%	67	22.5% (59.3%)	44	34.1% (36.9%)
600's	330	32.7%	101	33.9% (30.6%)	45	34.9% (13.6%)
700's	22	2.2%	4	1.3% (18.2%)	1	0.8% (4.5%)
800's	5	0.5%	0	0.0% (0.0%)	0	0.0% (0.0%)
900's	77	7.6%	16	5.4% (20.8%)	5	3.9% (6.5%)
TOTALS	1010		282	(27.9%)	129	(12.8%)

Indexing and Price

The last two characteristics that we will examine in this section are indexing and price. (See Tables Seven and Eight.) Indexing seems to be a very strong indicator of use. While this is not surprising, the apparent strength of the relationship might be unexpected by some in the JAS context. We should though note that a substantial minority of the used titles were not indexed. While this may be an artifact of the use of Ulrich's as the source of indexing information, it may instead indicate the need for some relatively obscure titles.

There is little to be said about price except that there is a slight tendency for more expensive titles to be disproportionately used, even though most of the used titles are less expensive. But again since the sample size is small, these conclusions must be made cautiously.

Table Seven
Indexing by Category of Use

Number of Times Indexed	Full Sample		Used One or More		Used Five or More	
	No. of Titles	Col. %	No. of Titles	Col. % (Row %)	No. of Titles	Col. % (Row %)
None	752	74.5%	93	33.0% (12.4%)	26	20.2% (3.5%)
Once	112	11.1%	72	25.5% (64.3%)	30	23.3% (26.8%)
More than Once	146	14.5%	117	41.5% (80.1%)	73	56.6% (50.0%)
TOTALS	1010		282	(27.9%)	129	(12.8%)

Table Eight
Price by Category of Use

Price	Full Sample		Used One or More		Used Five or More	
	No. of Titles	Col. %	No. of Titles	Col. % (Row %)	No. of Titles	Col. % (Row %)
Missing	139	13.8%	16	5.8% (11.5%)	5	3.9% (3.6%)
Free to $5	285	28.2%	45	16.0% (15.8%)	18	14.0% (6.3%)
$6 to $10	187	18.5%	57	20.2% (30.5%)	22	17.1% (11.8%)
$11 to $25	213	21.1%	81	28.7% (38.0%)	35	27.1% (16.4%)
$26 to $50	108	10.7%	53	18.8% (49.1%)	34	26.4% (31.5%)
$51 to $100	50	5.0%	18	6.4% (36.0%)	10	7.7% (20.0%)
$101 and up	28	2.8%	12	4.3% (42.9%)	5	3.9% (17.9%)
TOTALS	1010		282	(27.9%)	129	(12.8%)

CORRELATING USE BY PERIOD

Many studies of the use of journals have shown that past use is the best predictor of future use.[55] Because of the length of its coverage, this study can shed some light on this issue. Examineing the correlation of use between periods (see Table Nine) we see that it is between 0.35 and 0.60. The correlation between use in any given period and the use for the full study is between 0.65 and 0.85. This suggests that if the period of time in which we establish use is long enough, then past use may be a good predictor of future use. However this may the result of librarians coming to rely on JAS for particular title, and not the result of a consistent demand for a given title. Once again we have suggestive data, but no conclusive results.

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55. See for example, Fussler and Simon, 1969. or Urquhart and Urquhart, 1976.

Table Nine
Correlation Coefficients of Use by Period

	1	2	3	4	5	6	7	Total
1	1.000	0.574	0.403	0.396	0.357	0.526	0.389	0.653
2	0.574	1.000	0.473	0.558	0.530	0.598	0.583	0.826
3	0.403	0.473	1.000	0.492	0.429	0.573	0.356	0.702
4	0.396	0.558	0.492	1.000	0.574	0.559	0.483	0.804
5	0.357	0.530	0.429	0.574	1.000	0.502	0.405	0.697
6	0.526	0.598	0.573	0.559	0.502	1.000	0.561	0.841
7	0.389	0.583	0.356	0.483	0.405	0.561	1.000	0.711
Total	0.653	0.826	0.702	0.804	0.697	0.841	0.711	1.000

Periods:

1. September - December 1977
2. 1978
3. January - June 1979
4. July 1979 - June 1980
5. July - December 1980
6. 1981
7. January - June 1982

REGRESSION ANALYSIS AND THE KRAFT MODEL

In this section we will attempt to fit a regression model to the data to determine how well we can predict the use of journal titles. In light of these results, we will test the Kraft model for journal selection.

Simple Regression Models

This analysis begins with the use of a title in the first two periods (September 1977 to December 1978) and tested this use as a predictor of use in the last five periods (January 1979 to June 1982). Given the results of the correlations of use given in the previous section, we would expect considering this model to generally be a good one (see Table Ten); both the T-values and the F-value are high, as is the R-square. If we look at the results of the second regression model, which includes only the titles that received some use, we see that while the model may still predict effectively, the F-value and the R-square are less than in the first model. This suggests that the use predicting use model might better be described as the no uses predicts no use model. This trend in the data is evident in Figure Two. Here we have plotted use in the first period against use in the second period without the unused titles. While there seems to be a relationship at the high end, it is much less clear at the low end. At least with this data, past use is a fairly good predictor of future use, but it is not flawless.

To determine whether the number of uses or the number of users better predictors, we tested the ability of the number of uses and the number of users in the period July 1979 to June 1980 to predict use in all of the other periods. We used both a model that included all of the titles in the sample and a model that only considered titles that received use. (See Table Eleven.) We see that the number of users is a slightly better predictor in both cases. We also see again that removing the unused titles from the model weakens its predictive power.

Table Ten
Simple Regression Models -- Use Predicting Use

All Titles Included

	Estimate	T - Value	PR > |T|	Std. Error
Intercept	0.6649	5.85	0.0001	0.1136
Use in First Two Periods	2.0265	39.12	0.0001	0.0518
F - Value	1530.13			
PR > F	0.0001			
R - Square	0.6029			

Only Used Titles Included

	Estimate	T - Value	PR > |T|	Std. Error
Intercept	2.8570	6.79	0.0001	0.4209
Use in First Two Periods	1.7804	17.55	0.0001	0.1015
F - Value	307.99			
PR > F	0.0001			
R - Square	0.5238			

Table Eleven
Uses versus Users as a Predictor of Use

All Titles Included

Independent Variable	R - Square	F - Value
Uses	0.5511	1237.32
Users	0.6098	1575.26

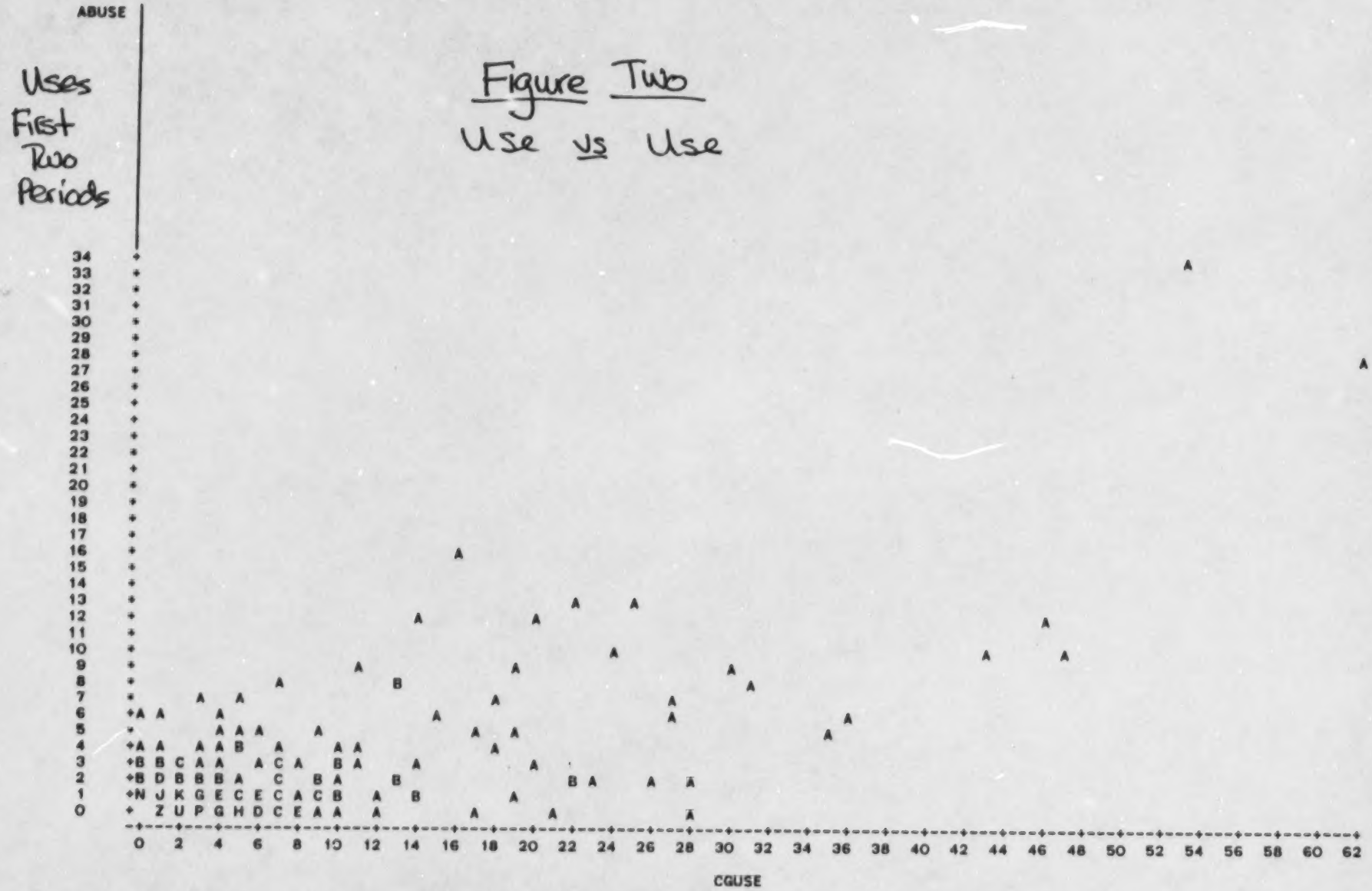
Only Used Titles Included

Uses	0.4592	223.34
Users	0.5143	278.44

PLOT OF ABUSE*CGUSE LEGEND: A = 1 OBS, B = 2 OBS, ETC.

Figure Two

Use vs Use



NOTE: 28 OBS HIDDEN

Uses last five Periods

Multiple Regression Models

Here we examine the construction of regression models that include factors other than past use to predict future use. The factors included in this analysis include:

1. Use in the First Period (September 1977 to December 1978).
2. Indexing.
3. Citation.
4. Impact.
5. Price.
6. Number of Subscriptions.
7. OCLC Holdings.
8. Subject. (Three subject areas were considered, Science, Social Science and Technology. They were made zero-one variables rather than categorical variables.)

It should be noted that 421 observations were not considered in this analysis because they lacked values for one or more of the variables. Two tacks were taken. The first included use in the first two periods the second did not.

When use in the first two periods is included in the model, as expected it is the best single variable predictor. As additional variables are added to the model it becomes a slightly better predictor, but only the addition of indexing raises the R-square by any noticeable amount. In Table Twelve we can see the effect of adding variables to the model. The SAS MAXR procedure was used to find the model with the highest R-square for each number of variables included. Table Thirteen shows the largest model where all of the variables are significant at the 0.1 level.

When use in the first two periods is not included in the analysis, a number of variables increase the R-square noticeably as they are added to the model. Indexing is the best single variable model. Science is then added, followed by price. Both of these variables seem useful additions to the model; the others add less. (Again see Tables Twelve and Thirteen.) As expected these models are less effective than those that include use.

Like the simple regression models, these models seem to point directions, but again one does not want to follow them

blindly. They provide insight into the most significant variables, but one would not expect the use of a small sample of titles to be predicted with much accuracy.

Table Twelve
The Effect of Adding Variables to Multiple Regression Models

Use in Period the First Two Periods Included

Variables	R - Square	F - Value
USE	0.5301	662.30
USE, INDEX	0.5634	378.21
USE, INDEX, OCLC	0.5692	257.63
USE, INDEX, OCLC, SCI	0.5727	195.65
USE, INDEX, OCLC, SCI, TECH	0.5751	157.82

Use in Period One Not Included

Variables	R - Square	F - Value
INDEX	0.1647	115.75
INDEX, SCI	0.1962	71.50
INDEX, SCI, PRICE	0.2046	50.17
INDEX, SCI, PRICE, OCLC	0.2074	38.21
INDEX, SCI, PRICE, OCLC, IMPACT	0.2094	30.88

Table Thirteen
Multiple Regression Models

Use in Period One Included

	B - Value	F - Value	PR > F	Std. Error
Intercept	0.1007			
Use in First Two Periods	1.8780	513.76	0.0001	0.0829
Science	1.4934	6.68	0.0100	0.5778
Technology	0.6284	3.35	0.0676	0.3431
Indexing	0.8620	36.50	0.0001	0.1427
OCLC	-0.0083	5.72	0.0171	0.0035
F - Value	157.82			
PR > F	0.0001			
R - Square	0.5751			

Use in Period One Not Included

	B - Value	F - Value	PR > F	Std. Error
Intercept	0.5274			
Science	3.3778	20.09	0.0001	0.7537
Indexing	1.3330	66.33	0.0001	0.1637
Price	0.0129	6.24	0.0127	0.0052
F - Value	50.17			
PR > F	0.0001			
R - Square	0.2046			

Testing the Kraft Model

For the Kraft model to be considered effective the cost/benefit, or in our case cost per use, must be relatively consistent over time. If not, the model is of little value. To test this assumption we ran two tests. First we ran a simple regression with the cost per use in the first two periods as the independent variable and the cost per use in the last five periods as the dependent variable. Because often titles were not used in one or both of the periods we assigned an arbitrary use of 0.25 in the first two periods and 0.5 in the last five periods. This allowed us to consider all of the titles in the sample in the test. The results seem to be most impressive. (See Table Fourteen.) But as has become our practice we tested the same model, except that we included only those titles that were used in both periods. We found that the model predicts satisfactorily, but not nearly as impressively as before. Once again it seems that the model can predict with some power, but it generally predicts lack of use better than use.

It might have been useful to use our earlier regression models to predict a cost per use and then to test it against the actual cost per use in a later period. Given the variances of the regression models, however, this was not done; the variances in the cost per use relationship would have compounded the variances of the regression model. Such a model would likely have some predictive power, but would not be satisfactory for selection in practice.

Table Fourteen
Cost/Use as a Predictor of Cost/Use

All Titles Included

	Estimate	T - Value	PR > |T|	Std. Error
Intercept	-3.1013	-1.04	0.2967	2.9703
Cost/Use in First Two Periods	1.0554	89.19	0.0001	0.0118
F - Value	7955.12			
PR > F	0.0001			
R - Square	0.9015			

Only Used Titles Included

	Estimate	T - Value	PR > |T|	Std. Error
Intercept	6.6892	2.06	0.0415	3.2483
Cost/Use in First Two Periods	0.8558	12.65	0.0001	0.0676
F - Value	160.04			
PR > F	0.0001			
R - Square	0.5518			

TESTING THE DHAWAN-PHULL-JAIN MODEL

The Dhawan-Phull-Jain journal selection model proposes that journals be divided into six priority groups and that the titles in the first group be selected before those in the second group, and those in the second before those in the third, etc. The proposed groups are:

1. Journals which are used, indexed and cited.

2. Journals which are used, indexed, but not cited.

3. Journals which are used, cited, but not indexed.

4. Journals which are used, but not indexed or cited.

5. Journals which are cited and indexed, but not used.

6. All other journals.

The data from this study gives us an opportunity to test this model in two ways. First we can test it against the use made of JAS. Secondly we can test it against the holdings in OCLC. The first test will indicate whether or not the model is of value in the context of a national resource center. The second test should indicate whether the composite selection of the nation follows the proposed pattern.

To test the model we will use in the first year and a half of the study as the measure of use. We will then compare the use received in the last three and a half years with the priorities assigned by the model. We will judge the model in two ways. First we will compare the performance of the six different categories. Secondly we will use regression to see how well the model predicts use and holdings.

Characteristics of Dhawan-Phull-Jain Categories

The most noticable finding is that no titles fall in the used, cited, but not indexed category. In our sample all of the cited titles are also indexed so there are no titles in this group. This of course results from using the ISI database as the source of citation information.

If we look at the mean use per title and the percentage of titles used in a given category we find results that support the model. (See Table Fifteen.) Unfortunately, our faith in the model must be lessened due to the high standard deviation for the mean use figure. Clearly there is a large variance in the amount of use any one title in a group is likely to receive. The mean holdings in OCLC generally meet our expectations from the model, that is, there are, on average, more holdings for the priority groups, but again the variance is high. However, there is one notable exception. Unused, but cited and indexed titles are very widely held. Reflection upon the nature of the sample, however, provides a logical explanation for this result. This group, which contains only thirteen titles, is likely composed of those titles that are so widely held that they were not requested from JAS. From this analysis we can conclude that, while the model selects many titles as predicted, it also selects titles that do not receive as much use as would be expected.

Dhana-Phull-Jain Regression Models

In order to fit the regression models a dummy variable was created with values zero to five corresponding to the six categories. Two models were tested. In the first use in the last three and a half years of the study was the dependent variable. In the second the dependent variable was OCLC holdings. In both cases the independent variable was the dummy.

Both T-values indicate a good fit, but the R-squares are lower than we might have expected. (See Table Sixteen.) However, noting the number of unused titles that are in the lowest group easily explains this result. In the use model over 700 data points were of this type, and in the OCLC model over 600. The likely reason for the good fit is the lack of use or holdings for

such a large proportion of the sample. The Adjusted sample confirms this concussion. Here we have removed all of the titles which were not used in the second period. (See Table Seventeen.) In these regressions the F-values are lower, though still significant. The R-square is very low, again indicating a large variance in the model. This suggests that the model has limited predictive power. The model appears to predict lack of use or lack of holdings, but does may not predict use or holdings with the same power. It is, of course, the latter that would be most valuable.

When we examine the correlation coefficients we see that use in the first period is more highly correlated with use in the second period than with the dummy variable, but is less correlated than the dummy for OCLC holdings. The OCLC correlations are low in both cases. The correlations for the adjusted sample are even less compelling than those of the full sample. (See Tables Eighteen and Nineteen.)

Table Sixteen
Characteristics by Dhawan-Phull-Jain Categories

Category	Number of Cases	Mean Uses	Std. Dev.	Total Uses	Range of Use
No Use Not Indexed Not Cited	839	0.4	1.7	360	0 - 28
No use Indexed Cited	13	2.6	4.6	34	0 - 17
Used Not Indexed Not Cited	38	6.7	9.2	255	0 - 35
Used Not Indexed Cited	0				
Used Indexed Not Cited	71	8.0	9.9	572	0 - 53
Used Indexed Cited	49	11.3	13.4	555	0 - 62

(Continued)

Table Fifteen
Characteristics by Dhawan-Phull-Jain Categories
(Continued)

Category	% of Titles Used	Mean Cost per Title	Mean Hold	Holdings Range
No Use Not Indexed Not Cited	13.9%	$19.20	9.7	0 - 335
No use Indexed Cited	53.8%	$61.77	152.7	71 - 360
Used Not Indexed Not Cited	68.4%	$21.35	29.6	0 - 185
Used Not Indexed Cited	N/A			
Used Indexed Not Cited	91.5%	$21.12	39.3	0 - 338
Used Indexed Cited	95.9%	$54.85	94.8	4 - 549

Table Sixteen
Dhawan-Phull-Jain Regression Models
(Unadjusted)

Use as the Dependent Variable

	Estimate	T - Value	PR > |T|	Std. Error
Intercept	0.4707	2.98	0.0029	0.1578
DPJ	2.1046	21.09	0.0001	0.0998
F - Value	444.86			
PR > F	0.0001			
R - Square	0.3062			

OCLC Holdings as the Dependent Variable

	Estimate	T - Value	PR > |T|	Std. Error
Intercept	10.7174	7.33	0.0001	1.4622
DPJ	12.6626	13.70	0.0001	0.9246
F - Value	187.55			
PR > F	0.0001			
R - Square	0.1569			

Table Seventeen
Dhawan-Phull-Jain Regression Models
(Adjusted)

Use as the Dependent Variable

	Estimate	T - Value	PR > |T|	Std. Error
Intercept	3.387	4.50	0.0001	0.7532
DPJ	1.604	6.34	0.0001	0.2528
F - Value	40.25			
PR > F	0.0001			
R - Square	0.1340			

OCLC Holdings as the Dependent Variable

	Estimate	T - Value	PR > |T|	Std. Error
Intercept	28.9999	5.08	0.0001	5.7051
DPJ	7.6954	4.02	0.0001	1.9147
F - Value	16.15			
PR > F	0.0001			
R - Square	0.0585			

Table Eighteen
Dhawan-Phull-Jain Correlation Coefficients
(Unadjusted)

	DPJ	Use Per 1	Use Per 2	OCLC Hold
DPJ	1.000	0.589	0.553	0.396
Use Per 1	0.589	1.000	0.776	0.218
Use per 2	0.553	0.776	1.000	0.211
OCLC Hold	0.396	0.218	0.211	1.000

Table Nineteen
Dhawan-Phull-Jain Correlation Coefficients
(Adjusted)

	DPJ	Use Per 1	Use Per 2	OCLC Hold
DPJ	1.000	0.478	0.366	0.242
Use Per 1	0.478	1.000	0.738	0.107
Use per 2	0.366	0.738	1.000	0.047
OCLC Hold	0.242	0.107	0.047	1.000

CATEGORICAL APPROACH: COMBINING CRITERIA

Building on the preceding sections, this section will examine the effects of various composite strategies that the Center might choose in journal selection. Again we are looking for infrequently held titles that exhibit some use and thus are considered to be of some scholarly value.

To balance these somewhat contradictory pressures we propose that a group of titles be considered an effective addition to the collection if it meets the following criteria. The figures in parenthesis are suggested bench marks.

1. Mean use per title above some chosen level. (6 uses over five years.)

2. Cost per use below some chosen level. ($20 per use.)[56]

3. The percentage of titles acquired under a given strategy that are used is above some chosen level. (70% of the titles in the group acquired should be used in five years.)

4. The mean holdings per title below some chosen level. (Mean holdings for the group should be less than 20.) It may also be useful to look at the range of holdings, since a few heavily used and frequently held titles could skew the results.

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56. The cost per use was established on the basis of the following formula. It should not be seen as the "true" cost per use, but rather should be seen as an understated figure used for comparative purposes.

$$\text{Cost per Use} = \frac{\text{Mean Cost per Title} * \text{Number of Cases} * 5}{\text{Total Uses}}$$

Primary Variables

The primary variables in the analysis were the following:

1. Indexing. Even though some unindexed titles are often used, indexing appears to be the most powerful means of assuring use. It is also intuitively a good indicator of the value of a title.

2. Place of Publication. The alternatives considered were not United States, and not United State, United Kingdom or Canada. United Kingdom titles are excluded here even though they showed a strong tendency for use above, because they should be readily available from sources other than the Center.

3. Subject. The only alternative considered was whether the title was either Science or Technology (Dewey numbers 500-699).

4. Citation. It will be considered here even though in our sample all cited titles are also indexed.

5. Holdings. The current number of listings in the OCLC database was used as a surrogate for holdings. A number of ranges was considered.

6. Language. Here English or not English were the two cases examined.

Basic Analysis -- Simple Strategies

Two base strategies were considered. The results of the other strategies should be judged against them. The first, the low case, is the full sample. Representing the effect of random selection. The second is labeled CRL, and represents the results of choosing the titles that the Center either owned or purchased during the course of the study. Acceptable strategies should match or improve on this strategy. It is interesting to note that while the strategy pursued by the Center in the past generated a high mean use per title, some of the titles were widely held. For example, the Journal of Sex and Marital Therapy added in 1978, or the Journal of Development Economics added in

1975. The first shows 108 holdings and 87 uses, the second 90 holdings and 34 uses. (The characteristics of the titles mentioned in this section can be found in Appendix Two.)

In looking at the results of the simple strategies, only citation, and indexing in more than one place, improve on the CRL strategy. In both cases, however, the holdings per title are high. Indexing in only one place almost matches the CRL strategy, but again the holdings are high. The other strategies alone are not effective in terms of the number of uses, cost per use, or percentage of the titles used.

In looking at the simple strategies a number of things become clear; none of them are particularly surprising. First there are a number of strategies, such as citation and indexing, that lead to collections that are often used, but also frequently held. Other strategies, such as not U.S. or not English, lead to seldom held collections that are also seldom used. When we limit the holdings, as expected the titles are less often held, but the use is also lower. It is interesting to note that by imposing a lower limit on holdings, even a very low limit, the amount of use increases and the cost per use decreases. This may indicate that one way of judging the appropriateness of a title for the Center is to see if anyone else in the country holds it. While this may be an effective strategy, it will likely raise objections from some of the Center's larger members. We should also note that simply limiting the subject to science and technology is not a particularly effective approach.

It is clear that to produce an effective strategy we will have to combine a number of the simple strategies. On one hand we will need criteria to assure quality and some use, and on the other, we will want criteria to insure that the titles acquired do not unduly duplicate holdings of Center's members. The rest of this section examines various combinations in an effort to establish the most effective approach.

Table Twenty
Simple Strategies

Strategy	Number of Cases	Mean Uses	95% Conf. Inter. + or -	Std. Dev.	Total Uses
Base (Full Sample)	1010	2.3	0.5	7.3	2321
CRL	73	7.3	3.2	13.7	533
Sci & Tech	443	3.6	0.8	9.0	1573
Indexed	258	7.1	1.5	12.1	1839
Indexed More Than Once	146	9.3	2.3	14.4	1360
Cited	63	12.8	5.9	16.5	804
Not US	672	2.5	0.6	7.5	1672
Not US, UK or Canada	546	2.0	0.6	6.6	1099
OCLC <50	900	1.5	0.3	5.3	1352
OCLC 5<x<50	284	3.7	1.0	8.2	1044
OCLC <25	848	1.1	0.3	3.9	950
OCLC 2<x<25	364	2.2	0.6	5.4	791
Not Eng Lang	361	1.1	0.4	4.2	407

(Continued)

Table Twenty
Simple Strategies
(Continued)

Strategy	Mean Cost per Title	Cost per Use	% of Tites Used	Mean Hold per Title	Range of Hold
Base (Full Sample)	$22.11	$48.11	27.9%	18.5	0 - 549
CRL	$19.81	$13.57	60.3%	21.5	0 - 226
Sci & Tech	$27.19	$38.29	37.9%	17.8	0 - 338
Indexed	$28.83	$20.22	73.3%	52.3	0 - 549
Indexed More Than Once	$35.87	$19.25	80.1%	69.1	0 - 549
Cited	$55.66	$21.81	90.5%	106.5	4 - 549
Not US	$21.98	$44.17	29.0%	9.9	0 - 176
Not US, UK or Canada	$21.06	$52.31	25.8%	6.5	0 - 135
OCLC <50	$19.94	$66.40	21.8%	5.7	0 - 50
OCLC 5<x<50	$24.12	$32.80	46.5%	16.5	5 - 50
OCLC <25	$19.28	$86.05	19.0%	3.8	0 - 25
OCLC 2<x<25	$20.94	$48.19	33.0%	8.5	2 - 25
Not Eng Lang	$21.17	$93.89	20.2%	3.2	0 - 87

Complex Strategy #1 -- Science and Technology

Although the simple science and technology strategy gave only mediocre results, it is considered first because the Center has traditionally supported collections in this area. The results of the various strategies show (see Table Twenty-One) that it is difficult to construct an approach that will generate much use unless indexing is one of the criteria. This removes titles such as the Australian National Drycleaner or Floricoltura Pesciatina from the acquired group. But without further restriction the holdings of this strategy are high. The most effective criteria for limiting holdings is to restrict titles to those published in countries other than the U.S., U.K. or Canada. This strategy contains titles such as Revue Roumaine de Chimie or Ornis Scandinavia. The further restriction that the titles be in English has little effect. Given this result we can project that a restriction of non-English titles would produce about the same results. Although strategies that begin with a subject restriction of only science and technology can be developed that approach the bench mark criteria for effectiveness, no strategy mets them all.

Table Twenty-One
Complex Strategy #1 -- Science and Technology

Strategy	Number of Cases	Mean Uses	95% Conf. Inter. + or -	Std. Dev.	Total Uses
Sci & Tech	443	3.6	0.8	9.0	1573
Sci & Tech Not US	310	4.0	1.1	9.7	1244
Sci & Tech Indexed	174	8.0	1.9	12.6	1398
Sci & Tech OCLC <25	368	1.9	0.5	5.1	694
Sci & Tech Not US Indexed	130	9.0	2.3	3.4	1168
Sci & Tech Not US Indexed Eng Lang	55	10.0	3.4	12.7	548
Sci & Tech Not US, UK or Canada	252	3.6	1.1	8.9	900
Sci & Tech Not US, UK or Canada Indexed	102	8.1	2.4	12.6	831
Sci & Tech Not US, UK or Canada Indexed Eng Lang	30	8.1	3.3	9.2	244

(Continued)

Table Twenty-One
Complex Strategy #1 -- Science and Technology
(Continued)

Strategy	Mean Cost per Title	Cost per Use	% of Tites Used	Mean Hold per Title	Range of Hold
Sci & Tech	$27.19	$38.29	17.8%	17.8	0 - 338
Sci & Tech Not US	$26.43	$32.93	39.%	10.5	0 - 158
Sci & Tech Indexed	$35.93	$22.36	75.3%	38.6	0 - 338
Sci & Tech OCLC <25	$20.98	$55.62	29.1%	3.8	0 - 25
Sci & Tech Not US Indexed	$38.12	$21.21	77.7%	23.4	0 - 158
Sci & Tech Not US Indexed Eng Lang	$46.08	$23.12	85.4%	33.2	0 - 143
Sci & Tech Not US, UK or Canada	$24.41	$34.17	38.5%	6.6	0 - 126
Sci & Tech Not US, UK or Canada Indexed	$34.40	$21.11	75.5%	14.8	0 - 126
Sci & Tech Not US, UK or Canada Indexed Eng Lang	$37.31	$22.94	80.0%	16.1	0 - 76

Complex Strategy #2 -- Holdings Restrictions

This approach begins with holdings limits and then attempts to devise criteria that will identify the most used of the seldom held. As expected the indexing criteria provides one effective way of achieving this end. Even more effective strategies include restrictions on the place of publication and a minimum holdings requirement. For example limiting to less than 25 holdings, indexing and not U.S., U.K., or Canada results in a sample that includes titles such as the Egyptian Journal of Pharmaceutical Science, the Irish Journal of Psychology and the Limnological Society of Southern Africa. Journal. Each shows less than 20 holdings and more than ten uses. Language restrictions imposed on top of other criteria at this level have little effect.

Table Twenty-Two
Complex Strategy #2 -- Holdings Restriction

Strategy	Number of Cases	Mean Uses	95% Conf. Inter. + or -	Std. Dev.	Total Uses
OCLC <50	900	1.5	0.3	5.3	1352
OCLC <50 Indexed	175	6.0	1.5	10.1	1054
OCLC 5<x<50					
OCLC 5<x<50 Indexed	115	7.5	2.1	11.3	864
OCLC 5<x<50 Indexed Not US	91	8.7	2.5	12.3	788
OCLC <25 Indexed Not US, UK or Canada Eng Lang	33	6.5	2.8	8.1	214
OCLC 2<x<25 Indexed Not US, UK or Canada Eng Lang	25	8.4	3.3	8.4	210
OCLC 2<x<25 Indexed Not US, UK or Canada Not Eng Lang	50	5.8	2.6	9.4	291
OCLC 2<x<25 Indexed Sci & Tech	82	6.3	1.9	8.6	518

(Continued)

Table Twenty-Two
Complex Strategy #2 -- Holdings Restrictions
(Continued)

Strategy	Mean Cost per Title	Cost per Use	% of Tites Used	Mean Hold per Title	Range of Hold
OCLC <50	$19.95	$66.40	21.8%	5.7	0 - 50
OCLC <50 Indexed	$23.38	$19.41	69.7%	12.9	0 - 50
OCLC 5<x<50					
OCLC 5<x<50 Indexed	$24.62	$16.38	79.1%	19.0	5 - 50
OCLC 5<x<50 Indexed Not US	$24.90	$14.38	82.4%	17.0	5 - 50
OCLC <25 Indexed Not US, UK or Canada Eng Lang	$9.37	$7.22	69.7%	8.6	0 - 24
OCLC 2<x<25 Indexed Not US, UK or Canada Eng Lang	$9.91	$5.89	84.0%	11.2	2 - 24
OCLC 2<x<25 Indexed Not US, UK or Canada Not Eng Lang	$27.78	$23.87	74.0%	8.7	2 - 23
OCLC 2<x<25 Indexed Sci & Tech	$21.80	$17.25	76.8%	9.8	2 - 24

Complex Strategy #3 -- Indexing and Citation

This approach begins with the most effective criteria for identifying use and investigates ways of limiting holdings, without resorting to an explicit holdings restriction. Limitations on the place of publication provides a way of identifying titles that are less often held. In this situation the restriction of not English has some effect.

The set of titles cited is a complete subset of the indexed titles; all cited titles are also indexed. Given that cited titles are usually widely held, the indexed criteria appears to be more effective. If we limit cited titles to only those held by 25 libraries or less we have only eleven titles. This approach is considered too limiting.

It is our view that explicitly limiting the number of holdings is a more productive approach than attempting the same purpose indirectly.

Table Twenty-Three
Complex Strategy #3 -- Indexing and Citation

Strategy	Number of Cases	Mean Uses	95% Conf. Inter. + or -	Std. Dev.	Total Uses
Indexed	258	7.1	1.5	12.1	1839
Indexed Not US	176	7.7	1.8	12.0	1350
Indexed Not US Eng Lang	86	8.2	2.4	11.1	701
Indexed Not US, UK or Canada	130	7.2	2.0	11.7	941
Indexed Not US, UK or Canada Eng Lang	43	7.6	2.7	9.2	325
Indexed Not US, UK or Canada Not Eng Lang	60	5.4	2.2	8.7	321
Cited Not Eng	19	18.9	9.7	21.6	360
Cited Not US, UK or Canada	23	18.6	8.1	19.9	429

(Continued)

Table Twenty-Three
Complex Strategy #3 -- Indexing and Citation
(Continued)

Strategy	Mean Cost per Title	Cost per Use	% of Tites Used	Mean Hold per Title	Range of Hold
Indexed	$28.83	$20.22	73.3%	52.3	0 - 549
Indexed Not US	$32.05	$20.89	75.0%	25.8	0 - 176
Indexed Not US Eng Lang	$33.99	$20.85	81.2%	36.1	0 - 176
Indexed Not US, UK or Canada	$30.33	$20.95	72.3%	15.2	0 - 126
Indexed Not US, UK or Canada Eng Lang	$29.36	$19.42	74.4%	16.9	0 - 76
Indexed Not US, UK or Canada Not Eng Lang	$27.26	$25.43	68.3%	7.2	0 - 74
Cited Not Eng	$54.00	$14.25	100.0%	65.8	4 - 359
Cited Not US, UK or Canada	$75.04	$20.11	100.0%	42.2	4 - 126

Examples -- Latin America and Eastern Europe

Although the sample size in this study is not large enough to provide extensive analysis of the application of this approach to particular strategies involving geographic restrictions, the following two examples demonstrate the general effects of this approach.

Latin America. This sample includes the 39 titles published in Central and South America and the Caribbean. The use per title is very low (mean use per title of 0.4 over the five years of the study), as is the mean number of holdings per title (4.3 per title). The cost per use is, as expected given the low use, very high ($248.30 per use). If we limit the sample to only indexed titles, the results showed the expected improvement. While there are only five titles in this group and thus the results must be interpreted with caution, the performance shows marked improvements (2.6 uses per title and a cost of $17.30 per use). The holdings per title rises slightly to 5.4 per title. The title which generates the most use, Revista de Microbiologia, was used nine times and shows only ten holdings. It is important to note that the indexing criteria reduced the number of titles by 34, but only reduced the number of uses by two, graphically illustrating the power of the indexing criteria.

Eastern Europe. This sample includes 37 titles from Eastern Europe excluding the Soviet Union. This group performs reasonably well without restriction (4.9 mean uses per title and a cost of $20.10 per use). The mean number of holdings is only 5.5. When the group is restricted to only indexed titles the mean number of uses rises to 13.4 and a cost per use declines to $10.34 This is somewhat deceiving because one title, the Revue Roumaine de Chimie had 90 uses. (It was, in fact, the most used title in the study.) Without this title the mean uses per title would be 2.5 with no restriction, and 6.5 with the indexing criteria. A more representive title in this group might be Zellstoff und Papier which was used nine times and shows four holdings.

Table Twenty-Four
Examples -- Latin America and Eastern Europe

Strategy	Number of Cases	Mean Uses	95% Conf. Inter. + or -	Std. Dev.	Total Uses
Latin America	39	0.4	0.5	1.6	15
Indexed	5	2.6	3.5	4.0	13
Eastern Europe	37	4.9	4.9	15.3	183
Indexed	12	13.4	14.3	25.2	161

Strategy	Mean Cost per Title	Cost per Use	% of Tites Used	Mean Hold per Title	Range of Hold
Latin America	$19.10	$248.30	10.3%	4.3	0 - 23
Indexed	$9.00	$17.30	40.0%	5.4	0 - 11
Eastern Europe	$19.88	$20.10	45.9%	5.5	0 - 34
Indexed	$27.75	$10.34	83.3%	11.5	0 - 34

SUMMARY OF RESULTS

For the Center to serve an important role in cooperative journal acquisition there must be a class of journals that require regular use by the research library community, but which are not frequently held by its members. This study indicates that such a class of journals does exist, and thus suggests that the Center can play a significant role in a cooperative journals acquisitions program, and that JAS effectively serves the research library community.

Clearly the use of journals in the resource sharing context is a far form simple matter. Journals can not be divided simply into one or two classes, but rather they compose a broad continuum. We may use different characteristics of a title to make judgments about its likely use, but we must recall that there is a large variability in almost every case. It is the composite picture that all of the various characteristics provide which will be most useful, not any characteristic alone.

General Characteristics

The general characteristics of the use in this study were similar to those found in the two studies at the BLLD.

1. Most of the use came from a very few titles. 50% of the use was for only 3% of the titles and just over 12% of the titles supplied over 85% of the use.

2. Half of the used titles were published in either North America or the United Kingdom. Over 70% of the used titles were published in English.

3. Over 50% of the used titles were in the areas of science or technology. 70% of the titles used five or more times were in these areas.

Other significant general findings include:

1. Only about 25% of the titles in the sample were indexed, though of the used titles almost 65% were indexed.

2. The range of OCLC holdings for the sample was none to 549. Interestingly, the most held titles were not the most used. The group of titles with between 50 and 10 holdings included most of the heavily used titles.

3. Classes of titles that had disproportionate use included Russian, Dutch, British and Japanese titles, as well as science titles. As stated above, indexed titles were the most disproportionately used titles.

Correlation of Use by Period

While use in one period tended to be correlated to use in other periods, the relationship was not as strong as one might expect. The highest correlation was 0.6; the lowest was 0.35. Although past use seems to be a fair indicator of future use, in the context of JAS it is not an overpowering predictor.

Regression Analysis

Regression models that employed past use to predict future use were in general satisfactory. However, they are less so when the unused titles are removed. This indicates that the models predict lack of use better than they predict use.

The number of users predicted use slightly better than the number of uses a titles received.

In multiple regression models the only variable other than past use that added substantially to the predictive power of the model was indexing.

Multiple regression models that did not include past use as one of the variables in general had a high variability.

Models

Two models of journal selections were examined in the light of this data, the Kraft cost/benefit model and the Dhawan-Phull-Jain model. In both cases the models predicted use with reasonable power, but both were better predictors of titles that would not receive use than titles that would receive use. When the unused titles were removed from the analysis the results showed much variability. In general both models proved useful guides, but it would be unwise to base selections exclusively on either.

Categorical Approach

This approach was found to be the most satisfactory. It allows for the combination of characteristics of a title in ways not possible with the other approaches. It also is easily tied into collection efforts by other organizations, most notably RLG.

Criteria were found which balance the Center's need to provide titles of value to the research library community without unduly duplicating the holdings of its members. The most effective criteria were:

Criteria to Assure a Minimum of Quality and Use.

1. Indexed titles.

2. Titles that are held by at least two other libraries in the United States.

Criteria to Limit Duplication of Other Holdings.

1. Titles published outside the United States, Canada or the United Kingdom.

2. Titles that are held by fewer than twenty-five academic libraries in the United States.

RECOMMENDATIONS

1. Monitoring Use of JAS.

It is recommended that the Center store records of use, both of its collections and JAS in machine-readable form and monitor that use on a regular basis. This will enable the Center to refine its journal selection policies.

2. Guidelines for Journal Selection.

It is recommended that the Center adopt the following general guidelines for the selection of journals.

A. Titles should be indexed.

B. Titles should be published outside the United States, Canada or the United Kingdom.

C. Titles should be held by no more than 25 academic libraries in the United States, and held by at least two libraries.

D. Titles that have been used should be given priority over those which have not been used.

The holdings of titles added to the Center's collections should be regularly reviewed and titles which have become widely held since the Center began receiving then should be dropped.

3. Selecting Particular Journal Titles.

It is recommended that the Center work with RLG and other cooperative organizations to target areas in which the Center will collect journals. These targeted areas, when possible should build on the Center's strengths. Examples of such strengths would include Russian and Eastern European titles, especially in the sciences, and South Asian titles. The expansion of the Center's journal collection in Japanese science should serve as a model. The guidelines suggested above should be implemented in selecting particular titles.

Appendix One
OCLC as a Proxy for National Holdings

That OCLC holdings approximate true national holdings is not of extreme importance for this study, but if the Center is to employ the number of holdings in OCLC as part of its selection criteria, we should know how closely this figure represents the actual number of national holdings, especially if we will likely be use small figures to limit acquisitions. If, for example, 25 OCLC listings represent 50 actual holdings, we would use it quite differently than if it actually represents 30. This is a study in and of itself. But by looking at the few titles mentioned in this report we can get some indication of the validity of this measure. In practice one should check both OCLC and RLIN.

The titles mentioned in the text and their holdings in OCLC and a number of other union lists provides an informal guide to the appropriateness of the OCLC figure as a surrogate for national holdings.

Title	OCLC	RLIN	MULS	CASSI	NST 50-70	NST 71-75
Australian National Drycleaner	0	0	0		0	
Egyptian Journal of Pharmaceutical Science	14	2	1	23		11
Floricotura Pesciatina	0	0	0	0	0	
Irish Journal of Psychology	9	1	2			5
Journal of Development Economics	90	7	7			61
Journal of Sex and Marital Therapy	108	7	12		23	
Limnological Society of Southern Africa. Journal.	2	2	0	3	0	

Title	OCLC	RLIN	MULS	CASSI	NST 50-70	NST 71-75
Ornis Scandinavica	38	3	8			41
Revista de Microbiologia	10	2	0	11		9
Revue Roumaine de Chimie	29	4	3	35	46	
Zellstoff und Papier	4	2	0	7	5	

Appendix Two
Characteristics of the Journals Mentioned in the Text

Title	Place	Language	Subject (Dewey)	Indexed	Holdings	Uses
Australian National Drycleaner	AT	ENG	667	no	0	0
Egyptian Journal of Pharmaceutical Science	UA	ENG	615	yes	14	11
Floricotura Pesciatina	IT	IT	635	no	0	0
Irish Journal of Psychology	IE	ENG	150	yes	9	28
Journal of Development Economics	NE	ENG	338	no(?)	90	34
Journal of Sex and Marital Therapy	US	ENG	155	yes	108	87
Limnological Society of Southern Africa. Journal.	SA	ENG	574	yes	2	24
Ornis Scandinavica	NO	ENG	598	yes	38	27
Revista de Microbiologia	BL	ENG, SP, POR	576	yes	10	9
Revue Roumaine de Chimie	RM	ENG, FR, GR, RUS, SP	540	yes	29	90
Zellstoff und Papier	GE	GR	676	yes	4	9

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